REMARKS

In the specification, paragraph [0031] is proposed to be amended herein.

The Final Office Action mailed November 25, 2003, has been received and reviewed. Claims 3, 7, 12, 15, 16, 18, and 20 through 24 are currently pending in the application. Claims 3, 7, 12, 15, 16, 18, and 20 through 24 stand rejected. Applicant proposes to amend claims 3, 7, 12, 15, 16, 18, 20, and 21 and respectfully requests reconsideration of the application as proposed to be amended herein.

35 U.S.C. § 112 Claim Rejections

Claims 3, 7, 12, 15, 16, 18, and 20 through 24 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant respectfully traverses this rejection, as hereinafter set forth.

The Office Action states that paragraph [0031] of the Specification does not support the amendments to the claims. Applicant proposes to amend the Specification to support the amendments to the claims.

Applicant respectfully submits that each recess, in relation to each associated conductive structure, as shown in FIG. 7, is shown as imperforate and substantially conformally receives at least a portion of an associated conductive structure, which supports the proposed amendment to the claims and specification. Therefore, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112, first paragraph rejection in light of the proposed amendment to the Specification.

Claims 3, 7, 12, 15, 16, 18, and 20 through 24 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully traverses this rejection, as hereinafter set forth.

The Office Action states that Claims 3, 7, 12, 15, 16, 18, and 20 through 24 are indefinite for including the phrase, "the recesses having an imperforate boundary wall that is sized and

for including the phrase, "the recesses having an imperforate boundary wall that is sized and configured to at least partially conformally receive."

Applicant respectfully submits that claims 3 and 12, as proposed to be amended herein, each particularly and distinctly claims the invention. Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112, second paragraph rejection to claims 3 and 12. Also, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112, second paragraph rejection to Claims 15, 20, 21, 23, and 24, each of which depend from either Claim 3 or Claim 12.

Applicant further respectfully submits that the independent claim 7, as proposed to be amended herein, particularly and distinctly claims the invention. Therefore, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112 rejection to Claims 7, 16, 18, and 22.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,293,072 to Tsuji et al. taken together with JP 6-151,492

Claims 3, 7, 12, 15, 16, 18 and 20 through 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,293,072 to Tsuji et al. (hereinafter "Tsuji") taken together with JP 6-151492, (hereinafter "the '492 reference"). Applicant respectfully traverses this rejection, as hereinafter set forth.

> M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:
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> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The 35 U.S.C. § 103(a) obviousness rejections of claims 3, 7, 12, 15, 16, 18 and 20 through 24 are improper because the references do not teach all of the claim limitations and there is no motivation or suggestion to combine the references.

The '492 reference teaches that an encapsulant mold may be oriented vertically. However, the reference appears to be silent regarding recesses that support the balls of a BGA assembly.

The Tsuji reference teaches that precisely sized spherical terminal members may be aligned with depressions formed in the interior of an encapsulation mold wherein the depressions are sized and configured with a circular opening that is smaller than the diameter of a corresponding spherical terminal member. Col. 4, lines 27-44. Such a configuration allows for placement and retention of the precisely sized spherical terminal members in relation to the associated depressions by way distributing the spherical terminal members over the depressions in combination with a vacuum (negative) pressure generated within the depressions. Col. 3, lines 52-57; Col. 4, lines 27-44.

Independent Claim 3, as proposed to be amended herein, recites, *inter alia*, at least one encapsulant restraining cavity including at least one surface with recesses formed therein, each of the recesses having an imperforate boundary wall that is sized and configured to substantially conformally receive a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity.

Neither the Tsuji reference nor the '492 reference, taken alone or in combination, teach or suggest an encapsulant restraining cavity having a plurality of recesses, each recess having an imperforate boundary wall that is sized and configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity. Rather, Tsuji specifically teaches that the depressions are sized and configured with a circular opening that is smaller than the diameter of a corresponding spherical terminal member. Col. 4, lines 27-44. Therefore, Applicant respectfully requests reconsideration and allowance of independent Claim 3. In addition, the depressions of Tsuji are perforate, each having an aperture for communicating a vacuum (negative) pressure therein.

In addition, there is no motivation to combine the references. One of ordinary skill in the art would not be motivated to modify the Tsuji reference to form recesses wherein each recess has a boundary wall sized and configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity because Tsuji specifically teaches that the depressions are sized and configured with a circular opening that is smaller than the diameter of a corresponding spherical terminal member. Col. 4, lines 27-44. Therefore, Tsuji teaches away from a boundary wall that is configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity.

Further, Tsuji relies on gravity and vacuum pressure in combination with opposing horizontal orientations, as shown in FIGS. 4(B) and 4(C), to distribute the spheres upon the depressions. Col. 3, lines 16-32. The '492 reference teaches that an encapsulant mold may be oriented vertically. Further, it should be noted that Tsuji relies on the vacuum pressure to secure the spheres within the depressions during changing the opposing horizontal orientations, so as to allow some spheres to fall off of the mold, while retaining other spheres in the recesses. Also, such a vacuum pressure would appear necessary to hold the spheres upon the depressions in a vertical orientation, as taught by the 492 reference. However, such an arrangement would also require equipment not taught or suggested by either the '492 reference or Tsuji.

Therefore, the proposed combination requires a mold that may be selectively positionable in *two, opposing horizontal orientations and a vertical orientation while the depressions are held under a vacuum pressure*, in order to retain the benefits of the Tsuji invention. However, there is no teaching or suggestion, found in the references for a mold apparatus that is *selectively positionable in two opposing horizontal orientations as well as a vertical orientation while the depressions are held under a vacuum pressure.*

The Office Action states that the arguments concerning a lack of teaching of providing the mold in either the vertical or horizontal orientation is not understood as the '492 reference shows both a horizontal orientation and a vertical orientation. Applicant respectfully submits that such a statement appears to assume, without support from the text of the '492 reference, that the horizontal orientations are not cited and shown as prior art or conventional approaches. It

appears that at least FIGS. 2-4 of the '492 reference are directed toward conventional embodiments, since voids 40 are shown and labeled. Further, it would appear that none of the molding apparatus shown in FIGS. 5, 6, or 13 of the '492 reference are even arguably capable of performing the opposing horizontal orientations and vertical orientation of a mold under vacuum pressure that would be required by Tsuji according to the proposed combination.

Therefore, Applicant respectfully submits that there is no teaching or suggestion of the attendant equipment and fixtures that would be necessary to operate a mold apparatus that is selectively positionable in two opposing horizontal orientations and a vertical orientation while the recesses are held under a vacuum pressure. Rather, Applicant respectfully submits that Tsuji and the '492 reference teach and suggest different orientations suited for their purposes.

Therefore, Applicant respectfully requests reconsideration and allowance of independent claim 3.

Claim 16 is allowable as depending directly from independent claim 3, which is allowable. Applicant respectfully requests reconsideration and allowance of dependent claim 16.

Independent Claim 7, as proposed to be amended herein, recites, *inter alia*, "each of the recesses defined by an imperforate boundary wall that is sized and configured to substantially conformally receive one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity." The references, taken alone or in combination, fail to teach or suggest all of the claim limitations. Accordingly, Applicant respectfully requests reconsideration and allowance of independent Claim 7.

Claim 18 is allowable as depending directly from independent Claim 7, which is allowable. Applicant respectfully requests reconsideration and allowance of dependent Claim 18.

Independent Claim 12, as proposed to be amended herein, recites, *inter alia*, multiple cavities including recesses formed in the inside surface on the at least one of the first member and the second member recesses, each of the recesses defined by an imperforate boundary wall that is sized and configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding from the substrate positionable in the at least one of the multiple cavities. Applicant respectfully submits that, as discussed above, the references,

taken alone or in combination, fail to teach or suggest all of the claim limitations. Applicant respectfully requests reconsideration and allowance of independent Claim 12.

Claims 15, 20, and 21are each allowable as each depend directly from independent Claim 12, which is allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of each of dependent Claims 15, 20, and 21.

Further, claims 22 through 24 each recite, *inter alia*, "wherein the plurality of conductive structures comprise pillars or columns." The Office Action asserts that it would have been obvious to modify the shape of the recesses to support pillars or columns such that the entire pillar or column was not covered by encapsulating resin." Applicant respectfully disagrees that such a combination would have been obvious to one of ordinary skill in the art.

First, the Tsuji and the '492 reference do not teach or suggest such a limitation. The Examiner is respectfully reminded that the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P. 706.02(j); *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438. Applicant respectfully submit that both Tsuji as well as the '492 reference appear to be silent with respect to conductive structures that are configured as pillars or columns.

Even assuming, *arguendo,* that either of the references taught or suggested such a configuration, Applicant respectfully submits that it would seem particularly inconsistent to configure the conductive structures as pillars or columns given the principle of operation to distribute the conductive structures that is taught by Tsuji. Applicant respectfully reminds the Examiner that Tsuji teaches that the conductive *spheres* are disposed upon and settle into depressions that are sized and configured as circular openings that are smaller than the diameter of corresponding spherical terminal members. Col. 4, lines 27-44. Further, placement and retention of the precisely sized spherical terminal members in relation to the associated depressions is achieved by way distributing the spherical terminal members over the depressions in combination with a vacuum (negative) pressure generated within the depressions. Such a mechanism for placing and retaining conductive structures would appear to be successful based, at least in part, on the *shape* of the conductive structures, namely, that Tsuji teaches spherically shaped conductive structures.

It is wholly unclear how the teachings of Tsuji may be achieved if the conductive structures were shaped as columns or pillars. Rather, it would appear highly unlikely that the teachings of Tsuji could be practiced with the conductive structures comprise pillars or columns. Therefore, Applicant respectfully submits that it would not be obvious to one of ordinary skill in the art to make the proposed combination for the reason that such a configuration does not exhibit a reasonable expectation of success.

In addition, Claim 22 is allowable as depending directly from independent Claim 3, which is allowable. Also, Claim 23 is allowable as depending directly from independent Claim 7, which is allowable. Moreover, Claim 24 is allowable as depending directly from independent Claim 12, which is allowable.

Therefore, Applicant respectfully requests reconsideration and allowance of Claims 22 through 24.

Obviousness Rejection Based on U.S. Patent No. 6,187,612 to Orcutt taken together with JP 6-151492

Claims 3, 7, 12, 15, 16, 18 and 20 through 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,187,612 to Orcutt (hereinafter "Orcutt") taken together with JP 6-151492. Applicant respectfully traverses this rejection, as hereinafter set forth.

The teachings of the '492 reference are discussed hereinabove.

Orcutt teaches a method of forming a ball grid array package wherein a mold comprising a first mold die having a cavity therein for receiving a ball and a second mold die for mating with the first mold die are provided, wherein a deformable material is placed in the cavity and the ball is placed in the cavity over the deformable material and the mold is closed to cause the ball to deform the deformable material within the cavity. Then, the molding composition (encapsulant) is injected between the first and second mold dies. Such a configuration may prevent the encapsulant from covering the entire exposed surface of the ball.

The Orcutt reference includes embodiments which may not function in a vertical orientation. Specifically, the embodiments do not appear suitable for resisting the force of gravity in a vertical orientation because the depressions will allow the substrate to move

vertically. Particularly, the embodiment shown in FIG. 3 of Orcutt shows that a deformable material 17 and 15 may be placed on the upper and lower sides of substrate 11. Thus, prior to compressing the mold upon the deformable materials, (i.e., when the mold is open for disposing the substrate therein) there would be clearance that would allow the substrate and balls attached thereto to move, if positioned in a vertical orientation. Thus, the mold of Orcutt would not function solely in a vertical orientation because the substrate would not be reliably positionable within the mold members.

Even assuming, *arguendo*, that the mold as taught by Orcutt could be first oriented in a horizontal fashion, closed to compress the deformable materials, and then, subsequently oriented vertically, as pointed out above, it would appear that none of the molding apparatus shown in FIGS. 5, 6, or 13 of the '492 reference are even arguably capable of performing both horizontal and vertical orientations.

Independent Claim 3, as proposed to be amended herein, recites the presence of at least one encapsulant restraining cavity having at least one surface with recesses formed therein, each of the recesses having an imperforate boundary wall that is sized and configured to substantially conformally receive a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity.

Neither the Tsuji reference nor the '492 reference, taken alone or in combination, teach or suggest an encapsulant restraining cavity having a plurality of recesses, each recess having an imperforate boundary wall that is sized and configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity. Rather, Orcutt specifically teaches that the depressions contact the balls only at the lowermost regions of the depressions, since the depressions are larger than the size of a corresponding conductive element. *See* FIGS. 1, 2b, and 3. Therefore, Applicant respectfully requests reconsideration and allowance of independent Claim 3.

In addition, there is no motivation to combine the references. More particularly, Orcutt teaches a horizontal orientation of the mold, as shown in FIGS. 1 through 3. Further, horizontal orientation of the mold is required, since, as pointed out above, the substrate would not be

reliably positionable within the mold members. In contrast, the '492 reference teaches that an encapsulant mold may be oriented vertically.

Therefore, the proposed combination requires a mold that may be positionable in both a horizontal orientation and a vertical orientation, because both orientations would be required to for suitable operation of the proposed combination. However, there is no teaching or suggestion, found in the references for a mold apparatus that is selectively positionable in a horizontal orientation as well as a vertical orientation. Further, it would appear that none of the molding apparatus shown in FIGS. 5, 6, or 13 of the '492 reference are even arguably capable of performing a horizontal orientation and a vertical orientation of a mold that would be required according to the proposed combination.

Therefore, Applicant respectfully submits that there is no teaching or suggestion of the attendant equipment and fixtures that would be necessary to operate a mold apparatus that is selectively positionable in a horizontal orientation and a vertical orientation. Rather, Applicant respectfully submits that Orcutt and the '492 reference teach and suggest respective orientations preferably suited for their purposes.

Claim 16 is allowable as depending directly from independent claim 3, which is allowable. Applicant respectfully requests reconsideration and allowance of dependent claim 16.

Independent Claim 7, as proposed to be amended herein, recites, *inter alia*, each of the recesses defined by an imperforate boundary wall that is sized and configured to substantially conformally receive one of a plurality of conductive structures protruding from a substrate positionable in the at least one cavity. Applicant respectfully submits that the references, taken alone or in combination, fail to teach or suggest all of the claim limitations. Applicant respectfully requests reconsideration and allowance of independent Claim 7.

Claim 18 is allowable as depending directly from independent Claim 7, which is allowable. Applicant respectfully requests reconsideration and allowance of dependent Claim 18.

Independent Claim 12, as proposed to be amended herein, recites, *inter alia*, each of the recesses defined by an imperforate boundary wall that is sized and configured to substantially conformally receive at least a portion of one of a plurality of conductive structures protruding

from the substrate positionable in the at least one of the multiple cavities. Applicant respectfully submits that the references, taken alone or in combination, fail to teach or suggest all of the claim limitations. Applicant respectfully requests reconsideration and allowance of independent Claim 12.

Claims 15, 20, and 21are each allowable as each depend directly from independent Claim 12, which is allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of each of dependent Claims 15, 20, and 21.

Further, claims 22 through 24 each recite, *inter alia*, "wherein the plurality of conductive structures comprise pillars or columns." The Office Action asserts that it would have been obvious to modify the shape of the recesses to support pillars or columns such that the entire pillar or column was not covered by encapsulating resin."

Neither Orcutt nor the '492 reference teach or suggest such a limitation. The Examiner is respectfully reminded that the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P. 706.02(j); *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438. Applicant respectfully submit that both Orcutt as well as the '492 reference appear to be silent regarding conductive structures that are configured as pillars or columns.

Claim 22 is allowable as depending directly from independent Claim 3, which is allowable. Further, Claim 23 is allowable as depending directly from independent Claim 7, which is allowable. Also, Claim 24 is allowable as depending directly from independent Claim 12, which is allowable.

Accordingly, Applicant respectfully requests reconsideration and allowance of Claims 22 through 24.

ENTRY OF AMENDMENTS

The proposed amendments to the Specification and to claims 3, 7, 12, 15, 16, 18, 20, and 21 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the amendments do not place the application in condition for allowance, entry is respectfully requested upon filing of a Notice of Appeal herein.

CONCLUSION

Claims 3, 7, 12, 15, 16, 18, and 20 through 24 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,

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